sensitive enough to detect a 0.5-second duration 16 kHz land mobile transmission of 2.3 mW at 149 MHz and of 22 mW at 460 MHz.

Table 3-1. Probability of Interference

Land Mobile Channelization	MES Uplink Data Rate	Uniform Distribution: Random Selection	Uniform Distribution: Interstitial Selection	Clustered Distribution: Random Selection	Clustered Distribution: Interstitial Selection
25 kHz	9.6 kbps	0.00038	0.000055	0.0013	0.00020
	4.8 kbps	0.00025	0.0000058	0.00088	0.000022
	2.4 kbps	0.00016	0.00000093	0.00052	0.0000034
12.5 kHz	9.6 kbps	0.00023	0.00019	0.00075	0.00064
	4.8 kbps	0.00012	0.000020	0.00039	0.000069
	2.4 kbps	0.000067	0.0000024	0.00023	0.0000084
6.25 kHz	9.6 kbps	0.00014	0.00015	0.00049	0.00051
	4.8 kbps	0.000094	0.00011	0.00032	0.00037
	2.4 kbps	0.000066	0.000074	0.00023	0.00026

Table 3-2. Worst Case (Smallest) Mean Time Between Interference Events

Land Mobile Channelization	MES Uplink Data Rate	Uniform Distribution: Random Selection	Uniform Distribution: Interstitial Selection	Clustered Distribution: Random Selection	Clustered Distribution: Interstitial Selection
25 kHz	9.6 kbps	22 min	*3 hours*	7 min	42 min
	4.8 kbps	34 min	*24 hours*	10 min	*7 hours*
	2.4 kbps	50 min	*150 hours*	16 min	*41 hours*
12.5 kHz	9.6 kbps	36 min	44 min	11 min	13 min
	4.8 kbps	70 min	*7 hours*	22 min	120 min
	2.4 kbps	130 min	*60 hours*	36 min	*17 hours*
6.25 kHz	9.6 kbps	60 min	55 min	17 min	17 min
	4.8 kbps	90 min	75 min	26 min	23 min
	2.4 kbps	130 min	120 min	36 min	32 min

Table 3-3. Mean Time Between Interference Events For Typical Push-to-Talk User

Land Mobile Channelization	MES Uplink Data Rate	Uniform Distribution		Clustered Distribution	
		Random Selection	Interstitial Selection	Random Selection	Interstitial Selection
25 kHz	9.6 kbps	*37 hours*	10 days	*11 hours*	*69 hours*
	4.8 kbps	*56 hours*	100 days	*16 hours*	26 days
	2.4 kbps	*83 hours*	***21 months***	*27 hours*	68 days
12.5 kHz	9.6 kbps	*60 hours*	*73 hours*	*18 hours*	*22 hours*
	4.8 kbps	*120 hours*	29 days	*36 hours*	*200 hours*
	2.4 kbps	*210 hours*	***8 months***	*60 hours*	71 days
6.25 kHz	9.6 kbps	*100 hours*	*92 hours*	*28 hours*	*28 hours*
	4.8 kbps	*150 hours*	*130 hours*	*43 hours*	*38 hours*
	2.4 kbps	*210 hours*	*190 hours*	*60 hours*	*53 hours*

4.0 Interference from Land Mobile Stations into NVNG MSS Satellites

As discussed in Section 3, narrowband NVNG MSS networks will use dynamic channel assignment techniques to avoid channels being actively used by land mobile stations. Thus as long as the dynamic channel assignment system identifies all active land mobile channels, there is virtually no possibility of interference from land mobile stations into NVNG MSS satellites. This section focuses on the question of whether there will be a sufficient number of unused, clear, channels available to support NVNG MSS operations. This is not an issue for Land Mobile Service providers, rather it is a viability issue for NVNG MSS providers.

The number of clear channels available is a function the amount of shared spectrum, the number of land mobile stations in the satellite footprint, the activity of these stations, the land mobile channelization plan, and the NVNG MSS uplink data rate. A simulation program has been developed to determine the number of land mobile stations in the contiguous United States (CONUS) that can operate in the shared spectrum and still provide a minimum average of 6 clear channels per satellite for the NVNG MSS uplinks. An average of 6 clear channels per satellite would allow the NVNG MSS network to operate at 36% of theoretical capacity, 2.8 million monitoring packets per day from the CONUS. A detailed description of the simulation is provided in Appendix B.

The minimum average per satellite assumption is worst case, since the average over all of the visible satellites will be greater than the minimum average, and thus provides a lower bound on the number of land mobile stations that can operate in the shared spectrum. The satellite footprint is roughly the size of the CONUS, 12 million km^2.

Four land mobile station average activity factors were considered, 0.01, 0.003, 0.001, and 0.0003 Erlang[2]. These correspond to averages of 432, 130, 43, and 13 minutes per month of land mobile station transmissions, respectively. Assuming a 0.4 voice activity factor, the equivalent conversation times are 1,080, 325, 108, and 33 minutes per month. Note that the averages are over the entire population of land mobile stations and over the entire month.

Tables 4-1 shows lower bounds on the number of land mobile stations in the CONUS operating in 1 MHz of shared spectrum computed by the simulation program for the four different land mobile station activity factors. For each activity factor, the three land mobile channelization plans (25 kHz, 12.5 kHz, and 6.25 kHz spacing), and the three MES uplink data rates (9.6 kbps, 4.8 kbps, and 2.4 kbps) were considered.

The smaller the land mobile channels, the larger the number of land mobile stations. For a given land mobile channelization, the smaller the MES uplink data rate, the larger

[2] Erlang is a measure of traffic intensity. In this context it is a measure of the land mobile station utilization.

the number of land mobile stations. For all cases, the smaller the land mobile station average activity factor, the larger the number of land mobile stations.

Table 4-2 shows the lower bounds assuming 5 MHz of shared spectrum. Note that the lower bounds are significantly greater than 5 times those for 1 MHz of shared spectrum. Thus significant benefit is realized from allocating larger blocks of spectrum shared with Land Mobile Services to the NVNG MSS on a co-primary basis.

Frequency sharing between narrowband NVNG MSS networks and Land Mobile Services will allow the NVNG MSS networks to find sufficient clear channels to operate, with LMS characteristics as modeled.

Table 4-1. Lower Bound Number of Land Mobile Stations in 1 MHz of Shared Spectrum

		Land Mobile Station Average Activity Factor			
Land Mobile Channelization	**MES Uplink Data Rate**	**0.01 Erlang**	**0.003 Erlang**	**0.001 Erlang**	**0.0003 Erlang**
25 kHz	9.6 kbps	12,000	38,000	120,000	380,000
	4.8 kbps	17,000	55,000	170,000	550,000
	2.4 kbps	23,000	77,000	230,000	770,000
12.5 kHz	9.6 kbps	16,000	52,000	160,000	520,000
	4.8 kbps	24,000	80,000	240,000	800,000
	2.4 kbps	35,000	120,000	350,000	1.2 million
6.25 kHz	9.6 kbps	18,000	60,000	180,000	600,000
	4.8 kbps	35,000	120,000	350,000	1.2 million
	2.4 kbps	58,000	190,000	580,000	1.9 million

Table 4-2. Lower Bound Number of Land Mobile Stations in 5 MHz of Shared Spectrum

		Land Mobile Station Average Activity Factor			
Land Mobile Channelization	**MES Uplink Data Rate**	**0.01 Erlang**	**0.003 Erlang**	**0.001 Erlang**	**0.0003 Erlang**
25 KHz	9.6 kbps	110,000	370,000	1.1 million	3.7 million
	4.8 kbps	125,000	420,000	1.3 million	4.2 million
	2.4 kbps	170,000	570,000	1.7 million	5.7 million
12.5 KHz	9.6 kbps	115,000	380,000	1.2 million	3.8 million
	4.8 kbps	190,000	630,000	1.9 million	6.3 million
	2.4 kbps	255,000	850,000	2.6 million	8.5 million
6.25 KHz	9.6 kbps	120,000	400,000	1.2 million	4.0 million
	4.8 kbps	230,000	770,000	2.3 million	7.7 million
	2.4 kbps	450,000	1.5 million	4.5 million	15 million

APPENDIX A. Band-Scanning Receiver Sensitivity Analysis

Each Leo One USA satellite uses a band-scanning receiver to identify clear uplink channels for assignment to subscriber terminals. The receiver's detection sensitivity is given by:

$$P_T = k + T_R + B_R + L_D + SNR_D - G_R + FSL - G_T$$

where P_T is the in-band transmit power sensitivity (dBW)
- k is Boltzman's constant, -228.6 dB(W/Hz/°K)
- T_R is the receiver noise temperature (dB-°K)
- B_R is the receiver noise bandwidth (dB-Hz)
- L_D is the detection loss (dB)
- SNR_D is the required SNR for detection (dB)
- G_R is the receiver antenna gain in the direction of the transmitter (dBi)
- FSL is the free space loss from the transmitter to the receiver (dB)
- G_T is the transmit antenna gain in the direction of the satellite (dBi)

The receiver system noise temperature is 738° K and the receiver noise bandwidth is 2.5 kHz. A 2 dB detection loss is assumed. An SNR of 13.3 dB provides a 99.9% probability of detection and a 1% false alarm rate for a 0.4 millisecond duration signal.

The satellite antenna is iso-flux with -2 dBi nadir gain and the satellite altitude is 950 km. At 460 MHz, the free space loss is 145.3 dB. Assuming 0 dBi transmit antenna gain in the direction of the satellite and no excess path loss, the band-scanning receiver can detect a -3.3 dBW (470 mW) in-band transmit power signal anywhere in the satellite footprint.

If the transmit signal bandwidth is greater than 2.5 kHz then a correction factor is required. To first order the detectable transmit power is given by the transmit signal bandwidth divided by 2.5 kHz, times 470 mW. For example, for a typical land mobile transmit signal bandwidth of 16 kHz, the detection sensitivity is 3 W.

At 149 MHz the transmit power sensitivities are 49 mW in a 2.5 kHz bandwidth and 315 mW for a 16 kHz LMS signal.

The band-scanning receiver is significantly more sensitive to longer duration signals. Figure A-1 shows the in-band transmit power sensitivity for signal durations up to 0.5 seconds. The band-scanning receiver can detect a 0.5 second duration, 460 MHz, 2.5 kHz bandwidth, 3.5 mW transmit power signal anywhere in the satellite footprint with 99.9% probability. For a 16 kHz signal the sensitivity is 22 mW.

At 149 MHz the transmit power sensitivities are 0.4 mW and 2.3 mW, for 2.5 kHz and 16 kHz signals, respectively.

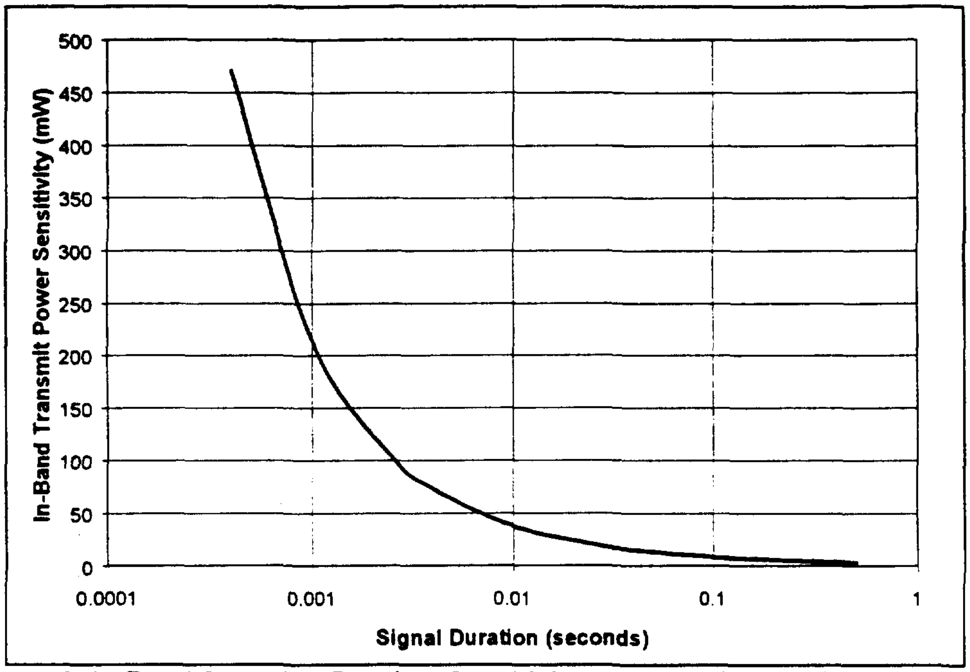

Figure A-1. Band Scanning Receiver Sensitivity as a Function of Signal Duration

APPENDIX B. Simulation Description

The results presented in Sections 3 and 4 were obtained using the simulations described in Sections B.1 and B.2, respectively. They represent several hundred hours of run time on a dual processor Sun Sparc20 workstation.

B.1 Interference from NGSO MSS MESs into Land Mobile Stations

The simulation determines the probability of interference assuming that dynamic channel assignment is <u>not</u> used. This worst case assumption provides an upper bound on the actual probability of interference for NGSO MSS networks <u>with</u> dynamic channel assignment.

The input parameters are:

1) Land Mobile Channelization Plan (25, 12.5 or 6.25 kHz) - Used to determine land mobile link center frequency and receiver IF bandwidth as shown in Table B-1.

Table B-1. Land Mobile Channelization Plans

Channelization Plan	IF Bandwidth
25 kHz	16 kHz
12.5 kHz	8 kHz
6.25 kHz	4 kHz

2) MES Uplink Data Rate (9.6, 4.8, or 2.4 kbps) - Used to determine the MES transmit spectrum as shown in Figure 2-1 and transmit power as shown Table B-2.

Table B-2. MES Transmit Powers

Data Rate	Transmit Power
9.6 kbps	7 W
4.8 kbps	3.5 W
2.4 kbps	1.75 W

3) MES Distribution (Uniform or Clustered)

4) MES Channel Selection (Random or Interstitial)

For a given set of input parameters, a sufficient number of ½-second trials are performed to insure that the computed probability of interference is reliable. For each ½- second trial the following steps are performed:

1. A land mobile transmitter location is randomly selected as the center of one of the 20 most populous cities in the CONUS.

2. The land mobile receiver location is randomly selected using a circular mass distribution from 0 to 20 km from the transmitter location.

3. A land mobile link center frequency, CF_{LM}, is randomly selected in a 1 MHz bandwidth based on the input land mobile channelization plan.

4. The land mobile receiver IF bandwidth, B_{IF}, is determined from the input channelization plan.

5. The distance between the land mobile transmitter and the land mobile receiver, d_{LM}, is computed.

6. 128 active MESs are randomly selected each ½-second over the CONUS using the input distribution, either uniform or clustered. This corresponds to over 22 million MES transmissions per day from the CONUS, which assumes that the NGSO MSS system is operating at 100% of theoretical capacity. This is another worst case assumption.

7. The distances, $d_{MES\text{-}LM}$, from each of the MESs to the land mobile receiver are computed.

8. Center frequencies, CF_{MES}, are randomly selected in a 1 MHz band for each of the MESs using the input selected method, uniform or interstitial.

9. The MES effective isotropic radiated power spectrum, $EIRP_0(f)$, is determined based on the input data rate.

10. The carrier-to-noise-plus-interference ratio is computed as follows:

$$C/(N+I) = \frac{\dfrac{10^{3.204}W}{d_{LM}^4}}{10^{-15.07}W + \displaystyle\int_{CF_{LM}-\frac{B_{IF}}{2}}^{CF_{LM}+\frac{B_{IF}}{2}} \sum_{MESs} \frac{10^{2.815}\cdot EIRP_0(CF_{MES}-f)}{d_{MES-LM}^4}\,df}$$

11. If C/(N+I) is less then 10.7 dB then the trial is deemed to have resulted in interference.

The probability of interference is computed as the ratio of the number of trials resulting in interference divided by the total number of trials.

For cases with low LMS traffic loading, the probability of interference is reduced by the Erlang factor for the channel.

B.2 Interference from Land Mobile Stations into NGSO MSS Satellites

The simulation determines the number of land mobile stations in the CONUS that can operate in the shared spectrum and still provide a minimum average of 6 clear channels per satellite for the NGSO MSS uplinks. This worst case assumption provides a lower bound on the number of land mobile stations that operate in the shared spectrum while still allowing the NGSO MSS network to operate at 36% of theoretical capacity.

The input parameters are:

1) Land Mobile Channelization Plan (25, 12.5 or 6.25 kHz) - Used to determine land mobile station center frequency grid, and land mobile transmit spectrum as shown in Figure 2-2.

2) MES Uplink Data Rate (9.6, 4.8, or 2.4 kbps) - Used to determine the NGSO MSS uplink center frequency grid as shown in Table B-3.

Table B-3. MES Uplink Channel Bandwidths

Data Rate	Channel Bandwidth
9.6 kbps	15 kHz
4.8 kbps	10 kHz
2.4 kbps	5 kHz

3) Amount of shared spectrum (1 MHz or 5 MHz).

4) Land mobile station average activity factor (0.01, 0.003, 0.001, or 0.0003 Erlang).

For each set of input parameters, the following steps are performed:

1. The initial number of land mobile stations is set to 1,000.

2. The land mobile stations are randomly distributed across the CONUS.

3. The land mobile transmitter effective isotropic radiated power spectrum, $EIRP_0(f)$ is determined based on the input land mobile channelization plan.

4. The NGSO MSS satellite system uplink channel bandwidth, BW, is determined based on the input MES uplink data rate.

5. For each trial, the NGSO MSS satellite constellation is randomly rotated in time, a sufficient number of trials are performed to insure that the computed number of land mobile stations is reliable. The following steps are performed:

   a) For each land mobile station, a transmit center frequency, CF_{LMS}, is randomly selected in the input amount of shared spectrum, 1 MHz or 5 MHz, based on the input land mobile channelization plan.

   b) For each land mobile station and for each NGSO MSS satellite the Doppler frequency shift, $\Delta f_{Doppler}$, is computed.

   c) For each NGSO MSS satellite and for each NGSO MSS uplink channel center frequency, CF_{CH}, in the input amount of shared spectrum, the interference-to-noise ratio is computed as follows:

$$(I/N)_{CH} = 10^{6.25} \cdot \int_{CF_{CH}-\frac{BW}{2}}^{CF_{CH}+\frac{BW}{2}} \sum_{LMSs} EIRP_0(CF_{LMS} + \Delta f_{Doppler} - f)df$$

   d) For each NGSO MSS satellite, the number of clear channels is computed as the sum of those with I/N < 10 dB.

6. If the minimum of the computed numbers of clear channels is greater than 6, then the number of land mobile stations is increased by 1,000 and the above procedure is repeated starting at step 2.

7. The process is completed when the maximum number of LMS stations that still allows for 6 clear channels is found.

ANNEX 3

DRAFT WAC-97 REPORT TEXT FOR SECTION 5.4 SHARING WITH THE MOBILE SERVICE

5.4.1 Summary of Frequency Sharing Studies Between Non-GSO MSS Below 1 GHz Earth-to-Space Links and the Land Mobile Service and Analysis of Their Results

IWG-2A studied the technical and operational issues relating to sharing between the land mobile service and the non-GSO/MSS below 1 GHz. Sharing between the MSS and terrestrial fixed and mobile systems, in the uplink direction can be accomplished by designing the MSS systems to operate in either a narrow-band, frequency-agile fashion to coexist with terrestrial services, or with wideband, low-power density, spread-spectrum transmissions which will provide sufficient margin against interference. Both of these transmission techniques reduce the possibility of interference to systems that share the same spectrum. In addition, the nature of the data-only services provided by MSS systems and the markets served by them are amenable to incorporation of other interference reduction techniques such as short, sub-second length data bursts and low-duty cycle transmission. The mobility of the users also reduces the coupling that can occur between MESs and other services operating in the band.

In one study a non-GSO MSS network had the following major characteristics: 48 satellites in 8 orbital planes in 950 km altitude circular orbits; narrow-band frequency division multiplexing for the Earth-to-space transmissions; operation in a store-and-forward mode; transmissions within 500 ms frames containing digital packets; satellite use of a band scanning receiver to implement a dynamic channel activity assignment system that assigns unused channels to earth stations for uplink transmissions; and uplink data rates of 2.4, 4.8, and 9.6 kbps. The land mobile station was modeled with the following characteristics: an analogue, frequency modulation system (or digitally modulated, binary-FSK system); a vertically polarized antenna having 0 dBi gain towards the satellite; 10 meter antenna height product (consistent with ITU-R Recommendation M.1039-1); minimum received signal power assumed to be -140 dBW; and channel bandwidths of 6.25, 12.5 and 25.0 kHz. These characteristics are shared by certain land mobile systems currently operating in frequency bands ranging from 138 MHz to 869 MHz. The analysis assumed multiple worst case conditions: 1) non-GSO MSS mobile earth stations (MESs) transmitting at 100% of capacity, 24 hours per day, 2) terrestrial stations and non-GSO MSS MESs geographically clustered in the same areas, and 3) dynamic channel avoidance not employed. For the worst case conditions stated, if the land mobile station is operated at push-to-talk rates of 0.01 Erlang, the land mobile station would experience a mean time between interference events of 2.5 days. For a variety of channelization plans, MES bit rates, and terminal distributions, the mean time between interference events for a typical land mobile user was found to range from 10 hours to 21 months. The land mobile user would observe the interference event as a single, short term event. Since in general the non-GSO MSS network will be able to identify active mobile channels, the actual interference from non-GSO MSS MESs into a given land mobile station will be much less than that calculated under the worst case assumptions used.

Narrow-band non-GSO MSS networks may use dynamic channel assignment techniques to avoid channels being actively used by land mobile stations. A Dynamic Channel Assignment Technique (DCAAS) could be used as described in Annex 2 to ITUR- M.1039 [Document 8/22]. This technique identifies all active land mobile channels so that there is virtually no possibility of interference from land mobile stations into non-GSO MSS satellites. Analysis based on observed band use worldwide shows there would be a sufficient number of unused, clear channels available to support non-GSO MSS operations. A simulation program was used to determine the number of land mobile stations within the satellite footprint that can operate in the shared spectrum and still provide a minimum average of 6 clear channels per satellite for the non-GSO MSS uplinks. Four different land mobile station activity factors, three land mobile channelization plans, and three MES uplink data rates were considered. The results indicate that with 6.25 kHz land mobile system channelization, 2.4 kbps MES uplink data rate, and 0.003 Erlang activity factor, 190 000 terrestrial mobile stations could operate within the satellite footprint (12 million km^2) and still leave a minimum of 6 clear channels for MES uplink transmission in 1 MHz of shared bandwidth. For the same conditions, but in 5 MHz of shared bandwidth, 1.5 million terrestrial mobile stations could operate. These results indicate that frequency sharing, as modeled, could allow the non-GSO MSS below 1 GHz networks to find sufficient clear channels to operate. The use of DCAAS also practically eliminates potential for interference between MESs and terrestrial services, as well, since occupied channels are avoided.

APPENDIX B

NVNG MSS and Broadcast Remote Pick-Up Can Successfully Share the 455 – 456 MHz Band

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19 December 1997

NVNG MSS and Broadcast Remote Pick-Up Can Successfully Share the 455 – 456 MHz Band

A simulation was developed to evaluate the potential for interference from NVNG MSS mobile Earth stations (MESs) into Broadcast Remote Pick-Up links in the 455 – 456 MHz. The simulation is described in the attached exhibit. The following assumptions were made:

- 500 million simulation trials, accuracy better than 0.00001%.
- 16 KHz RPU IF bandwidth.
- MESs distributed uniformly over the CONUS.
- Ambient nose level of –138 dBW, representative of urban environments.
- RPU base stations located at centers of 20 largest CONUS cities
- RPU mobile units located within radio-horizon of base stations with circular mass distribution.
- RPU and MSS share the 455 – 456 MHz band.
- RPU channel plan with 25 KHz center-to-center spacing.
- 17 dB RPU protection ratio.
- 15 meter RPU mobile station antenna height and 60 meter RPU base station antenna height.
- 5 dBi RPU mobile station antenna gain.
- 9 dBi RPU base station antenna gain.
- 8.2 KHz MES emission bandwidth.
- 7 watt MES transmit power.
- 2 meter MES antenna height.
- 0 dBi MES antenna gain in direction of RPU station.
- 99.8% DCAAS effectiveness.

The simulation results show that, even using these worst case assumptions, the probability of interference is only 0.00015%. This is equivalent to a single short, less than one-half second, interference event every 4 days, assuming that the RPU is operating continuously for that period. If the RPU only operated for 2.5 hours per day, then the average interval between short, one-half second, interference events would be a month.

Simulation Description

Five hundred million simulation trials were evaluated as described below. The probability of interference was then calculated as the number of trials resulting in interference divided by 500 million.

1) A RPU base station is randomly selected as the center of one of the 20 most populous CONUS cities.

2) A RPU mobile station location is randomly selected, in the same city as the base station, using a circular mass distribution from 0 km to the RPU radio-horizon.

$$RPU_{Radio-Horizon}(miles) = \sqrt{2 \times Height_{RPU-Base}(feet)} + \sqrt{2 \times Height_{RPU-Mobile}(feet)}$$

3) A RPU center frequency is selected in the 455 – 456 MHz bands as 455 MHz + (n + 0.5) x 25 KHz, where n is randomly selected from 0 to 39.

4) Determine if the DCAAS is effective for this RPU link. If it is, then the trial has not resulted in interference, otherwise proceed with the following steps.

5) 128 active MESs are randomly sited over the CONUS representing the Leo One USA peak theoretical capacity of 22 million packet transmissions per day.

6) For each MES the distance from the MES to the RPU station is computed.

7) For each MES a center frequency in the 455 – 456 MHz band is selected as (n + 0.5) x 2.5 KHz, where n is randomly selected from 0 to 399.

8) The received interference power at the RPU station, I, is computed by integrating the aggregate received MES power spectral density over the RPU IF bandwidth, of 16 KHz.

$$I(Watts) = \int_{RPUCF-IFBW/2}^{RPUCF+IFBW/2} 9(meters^2) \times h_{RPU}^2 \times G_{RPU} \times \sum_{MESs} \frac{\frac{7(Watts)}{8.2(KHz)} \times EIRP0(f - CF_{MES})}{Range_{MES-RPU}^4(meters)} \times df$$

where RPUCF is the RPU station center frequency (KHz)

IFBW is the RPU station IF bandwidth (KHz)

h_{RPU} is the RPU station antenna height (meters)

G_{RPU} is the RPU station antenna gain to first order, the MES power spectrum is given by EIRP0(f) = 1 for |f| < 4.1 KHz, and equals 0 elsewhere.

9) The received noise power at the RPU station, N, is –138 dBW, representative of an urban environment.

10) The received desired signal power at the RPU station, C, is

$$C(watts) = 10^{ProtectionRatio(dB)/10} \times N(Watts) \times \left[\frac{RPU_{Radio-Horizon}(km)}{Range_{RPUMobile-RPUBase}(km)} \right]^4$$

11) If C/(I + N) is less than the 17 dB protection ratio, then the trial has resulted in interference.

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Reply Comments of Leo One USA Corporation was sent by first-class mail, postage prepaid, this 22nd day of December, 1997, to each of the following:

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